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ABSTRACT

Resources and references concerning laboratory and classroom access for disabled people in the field of science and engineering are presented in this fact sheet. This information is intended to assist high school and postsecondary students, faculty members and administrators in recognizing the problems, solutions, and rewards of providing laboratory access for disabled persons. Major sections focus on: (1) the student (providing guidance and directives for choosing a science career); (2) the instructor (suggesting instructional strategies that have proved to be effective); (3) the administrator (highlighting ways of making laboratories accessible); (4) disability related accommodations (identifying resources for the hearing impaired, the learning disabled, the visually impaired, the vocally impaired, and for mobility impairments); and (5) organizations and publications (consisting of descriptions and addresses of resources associated with disabilities). (ML)

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ACCESS TO THE SCIENCE AND ENGINEERING LABORATORY AND CLASSROOM—1986 Edition

INTRODUCTION

The accomplishments of more than 1000 working scientists with disabilities and the historic contributions of such disabled scientists as Albert Einstein, Charles Steinmetz and Thomas Edison attest to individual strategies for overcoming barriers in the laboratory and science classroom. Most schools and colleges have made some effort to provide accessible labs and classrooms, making the pursuit of education and careers in laboratory sciences a completely viable option for interested disabled students. There are now many acceptable, cost-effective ways to make laboratories and science classrooms accessible.

This fact sheet presents resources and references concerning laboratory and classroom access for disabled people in the field of science and engineering. This information has been prepared to encourage high school and postsecondary students, faculty members and administrators to recognize the problems, solutions and rewards of providing laboratory access. Concrete examples and cost-effective suggestions provide a wide range of methods for making laboratories and science classrooms accessible.

FOR THE STUDENT

If you are interested in and have an aptitude for science or engineering, you will in all likelihood be able to pursue your interest. Your disability may require some special accommodations and services, and you will most likely develop your own coping strategies, but your goal is attainable. The generally sequential nature of science and engineering curricula requires that you familiarize yourself, as early as possible in your educational career, with the courses of study available. Be aware of prerequisites and how programs may differ from one college or university to the next. By using such knowledge, you will be better able to plan accordingly. Choosing a science field means recognizing your needs as they relate to your studies or career, planning ahead, informing instructors and colleagues when necessary, and retaining a sense of determination.

The American Association for the Advancement of Science (see the **RESOURCES** section) has a register of more than 1200 scientists and engineers with disabilities, of all disciplines and disabilities. These scientists and engineers are willing and available to share information and coping strategies by phone or letter. As professionals, these people may also be able to suggest the most appropriate science and lab courses suited to your field.

The AAAS is only one resource of many. **You** are probably your best resource. Think about your needs and how you have accommodated your disability in the past. Look at the lab facilities. Are there difficulties with their use? How could the facilities be modified to meet your needs? Discuss your needs with your instructors. They know the coursework and may be helpful in planning ahead. A counselor, a disabled student services officer, or a dean of students are also good resources as they may have had similar experiences with other students. Maintenance, engineering or physical plant personnel could suggest feasible structural modifications that may be necessary. Other students with disabilities are also good resources as they may have developed coping strategies that would also work for you. Be aware of the people available to assist you (see the **RESOURCES** section), but don't let discouraging advice stop you. If you don't know or are not sure of something—ASK! In short, leave no stone unturned.

Of great importance is the coordination and interaction of those people supporting you. Introduce your instructor to your counselor or advisor, introduce your vocational re-

habilitation counselor to the disabled student services officer. Finally, as you and your supporters begin developing strategies, be realistic and flexible in the solutions. Keep cost in mind, but remember you have a right to an accessible education.

FOR THE INSTRUCTOR

In order to teach them effectively instructors should be aware of the needs of students with disabilities in their programs. Most educational institutions have people with whom you can work who have experience making adaptations. In junior high and high schools, special education resource teachers may help. At colleges or universities, disabled student services coordinators can be of assistance. At each level disabled scientists and engineers who have coped with similar problems can be called upon to offer useful strategies.

Some strategies instructors have found useful in the past include:

- providing tactile versions of printed charts, graphs, and models for the visually impaired student
- allowing the student with a learning disability or motor impairment some extra time for completing lab assignments
- bearing in mind the needs of the student with a disability when assigning lab partners, and encouraging disabled students to participate
- distributing syllabi, assignments and other relevant course material as far in advance as possible, so the student with a disability can acquire texts on tape or make other preparations

Non-disabled students as well will benefit from such additional information as audio description intended for students with visual impairment, or visual description intended for students with hearing impairment. Waiving lab requirements or other assignments is never an acceptable solution.

Additional information on specific program adjustments that have been used successfully is available from the American Association for the Advancement of Science. People are encouraged to call or write with specific questions and to share successful adaptations. Using these resources as background, solutions can be worked out with the individual with a disability to construct the most satisfactory arrangement for all concerned.

FOR THE ADMINISTRATOR

Making your school's laboratories accessible is an investment that pays off each time a disabled student has the kind of hands-on experience critical to the study of science. Furthermore, once a lab station has been made accessible it may be used as is, or with some modification, by many students for years to come. Making a laboratory accessible need not be costly, particularly if the disabled individuals involved are consulted and a sensible approach is taken to meet their needs. For example, rather than lowering stationary lab equipment to meet the needs of a student who uses a wheelchair, it may be possible to raise the wheelchair and the student to the appropriate height. A wheelchair equipped to do this might be purchased by the department to have on hand for use by other students with mobility impairments. Strategies you develop to accommodate the needs of students with a hearing-impairment, visual impairment or learning-disability may be used repeatedly as well.

Most campuses have established a committee to assure compliance with the Rehabilitation Act of 1973. Section 504 requires recipients of Federal funds not to discriminate against people because of disability. Access to science and engineering labs for qualified people with disabilities is mandatory. The typical Campus Access Committee develops policies and procedures that can assure access. The committee is composed of a variety of campus and community representatives, and is an excellent resource when planning for science lab access. (See "Cost Effective Ideas" in the **RESOURCES** section at the end of this fact sheet.)

Specific information on how to make laboratories accessible is available from the American Chemical Society, the American Association for the Advancement of Science, the Association of Physical Plant Administrators, the National Rehabilitation Information Center,, and the Rehabilitation Engineering Society of North America (see the **RESOURCES** section). Coordinate your efforts with those of students, instructors and other support personnel.

FOR EXAMPLE

- David Young, a Ph.D. candidate in biometrics at the University of Colorado Health Sciences Center, stressed the importance of remaining flexible and open-minded in adapting to the conditions of one's disability. For Young, a quadriplegic, a well organized work space is essential. Therefore his desk is arranged so that the telephone, computer and reading materials are within reach of manipulation by use of his mouthstick.

- Dr. Anne Barrett Swanson, Associate Professor of Chemistry and Chairperson of the Department of Physical Science at Edgewood Col-

lege in Madison, Wisconsin, stressed the importance of adjustable height work surfaces. Swanson, disabled by congenital osteotenesis imperfecta ("brittle bones") resulting in short stature, suggested that a lowered work surface may be created by pulling out and turning over a drawer in an existing work bench. Swanson added that safety equipment can readily be made accessible. The pull-chains on drench showers can be lengthened and extension hoses may be attached to eye and face washes. The installation of an extension hose does not require movement of any plumbing fixtures and can be done for about $100.00. Pull-chains may be lengthened for as little as $1.49. Swanson pointed out that these adaptations benefit non-disabled students too, since a person needing to use a drench shower may not have the presence of mind to reach for the end of a pull-chain suspended seven feet above the floor. Contact: Dr. Swanson at Edgewood College, 855 Woodrow St., Madison, WI 57311.

• Ken Fertner, a scientist working at the Franklin Institute in Philadelphia, described a recently developed aid called a multimeter for visually impaired people working in the laboratory. A multimeter is a battery-operated, hand-held instrument that measures electricity (volts, current, resistance) and voices the measurement. The multimeter can voice the output of any piece of laboratory equipment that has an electronic (e.g., digital) readout. Thus the multimeter may be used in conjunction with: voltmeters, spectrometers, thermometers, scales, ph meters etc. (See **DISABILITY-RELATED ACCOMMODATIONS** section for availability of the multimeter.)

• Dr. Dorothy Tombaugh, Traveling Science Consultant, recommended the talking thermometer and the light probe as two of the most important pieces of lab equipment for the visually impaired science student. The talking thermometer consists of a thermometer wired to a voice box worn around the neck. This instrument voices the temperature of any substance into which the themometer is inserted. The light probe emits a tone that varies in pitch in response to changing light intensity. The light probe has many uses: registering color changes in chemical reactions, comparing the color of plants in a greenhouse, and noting differences in grays on a geology map, to name a few. (See **DISABILITY-RELATED ACCOMMODATIONS** section for availability of the light probe and talking thermometer.)

• Dr. Joseph Larsen, a wheelchair user who is the Director of the School of Life Sciences at the University of Illinois at Champaign-Urbana, suggested in an American Association for the Advancement of Science newsletter that laboratory modification made to meet the needs of specific disabled individuals provide a better, more efficient approach. Disabilities are too variable for any one type of work bench modification to be used by all, he said. Such temporary modifications are disassembled at the end of the term or course.

• At the University of Lowell in Massachusetts, four laboratory benches were constructed by the University's physical plant department according to a prototype designed and suggested to them by disabled science student Gary LeTourmeau. The benches can be raised or lowered to suit varying needs and individuals. For more information contact Dr. David Pullen, Physics Department, University of Lowell, 1 University Ave., Lowell, MA 01854, (617) 452-5000 x2574.

• The Chemistry Department at Brock University, Ontario, Canada, developed a wheelchair with an electric lift for mobility impaired chemistry students. The chair can be maneuvered in raised, lowered or intermediate positions. This permits access to standard chemical bench height experiments, sinks, fume hoods and stationary equipment without moving them. (See the **DISABILITY-RELATED ACCOMMODATIONS** section for availability information.)

• A window washer's belt was the solution developed by one paraplegic science student. The belt is hooked to the work bench and encircles her hips allowing her to stand at the chemistry bench with both hands free to work. This creative, simple and inexpensive solution may suggest similar unique solutions for paraplegics and other mobility impaired people.

• Wayne State University (WSU), in Michigan, is using a portable science station. It has a sink (with push button controls for water), convenient electrical outlets, propane burner and fume hood to vent noxious gases. The lab station costs about $5,000. There is an opening wide enough for a wheelchair and it can be used from either side. One side is designed for use in biology the other side for chemistry. Joe Oravec, science lab supervisor at WSU, said that while there are a relatively large number of mobility and/or visually impaired students, about 300, the station has been used by only about six students over the past two years. This is because disabled students have been discouraged in high school from pursuing laborabory science study, he said. Chemistry Department Chairman Dr. Milton Glick said that the lab station has both improved access and raised consciousness. (See the **DISABILITY-RELATED ACCOMMODATIONS** for availability of the portable science lab.)

• Mark Stern, a deaf undergraduate student at Stanford University, has a Superphone, a battery oper-

ated telecommunication device (TDD) that allows him to communicate over the telephone lines with faculty, advisors, and friends, and also to access the university computer system for assignments in engineering courses and a part-time job at the Medical Center. Purchase of a TDD that is compatible with the computer network greatly expands the number of individuals and departments with which he can communicate. (See the **DISABILITY-RELATED ACCOMMODATIONS** for availability of TDDs.)

DISABILITY-RELATED ACCOMMODATIONS

Patience, encouragement and open communication can surmount many difficulties. The accommodations below are listed by specific disability, though one aid may work well for several disabilities. However, an aid that works well for one person with a disability may not be suitable for someone else with the same disability. Adaptations are best worked out on an individual basis.

The accommodations listed are followed by sources for further information or specific distributors or manufactures.

FOR HEARING IMPAIRED STUDENTS

- **Interpreters** (manual or oral) National Registry of Interpreters for the Deaf, 814 Thayer Avenue, Silver Spring, MD 20910 (301) 588-2406 (The Registry issues regional directories of certified interpreters for $3.00 each plus postage.)
- **Notetakers** (Notetakers can take the form of simply providing the student with copies of another student's notes.) For information on special notetaking materials see NTID in the **RESOURCES** section.
- **Telecommunications Devices for Deaf Persons (TDD)** contact for resource directory TDI, Inc., 814 Thayer Ave., Silver Spring, MD 20910 (301) 589-3006 (TDD) (301) 589-3786 (Voice) also a brochure, "What You Should Know About TDD's" is available free from National Technical Institute for the Deaf P.O. Box 9887, 1 Lomb Memorial Drive, Rochester, N.Y. 14623–0887, (716) 475-6824 (Voice/TDD)
- **Personal Listening Devices and Room Amplification Systems,** e.g. systems for auditoria contact for references, SHHH 7800 Wisconsin Ave, Bethesda, MD 20814, (301) 657-2248 (Voice), (301) 657-2249 (TDD)
- **Computers** (standard computer technology present no barriers to hearing impaired students and are a positive alternative to conveying information. However, auditory cues are now being substituted for visual. This will present problems, which will require alternative output modes.)
- **Decoders to receive closed captioning on television:**
  —Sears, Roebuck and Co. (catalogue department)
  —J C Penny (catalogue department)
  —Video Concepts Stores (check local listings)
  —Hearing Aid Dispensors
  —Deaf and/or hard-of-hearing related organizations
  —National Captioning Institute, Sales Department, 5203 Leesburg Pike, 15th floor, Falls Church, VA 22041 (703) 998-2400
- **Captioned Science programs including NOVA Series:** PBS Video, Department C, 475 L'Enfant Plaza, SW, Washington, DC 20024 (800) 424-7963 Chedd-Angier Production Company, 70 Coolidge Hill Rd., Watertown, MA 02172 (617) 926-8300 Contact Mary Guest
- **Written summaries of demonstrations** (because students can't lipread and watch a demonstration at the same time)
- **Visual aids** (e.g. an overhead projector so that the instructor can continue to face the class while showing diagrams)
- **Visual warning signals** (e.g., flashing lights for alarms or timers) "Signaling Devices for the Hearing Impaired" available from the Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 (singles copies free) "Catalogue of Assistive Devices for the Hearing Impaired" available from Sound Resources, Inc., 201 E Ogden, Hinsdale, IL 60521, (312) 323-7970

FOR LEARNING DISABLED STUDENTS

- **Textbooks on cassette tape.** Recording for the Blind, 20 Roszel Road, Princeton, NJ 08540, (609) 452-0606 or (800) 221-4792
- **Location free from distractions** such as noisy air conditioner or busy hallway
- **Extra time** to complete examinations and assignments

FOR MOBILITY IMPAIRED STUDENTS

- The lab must be in an **accessible building.**

Creating an Accessible Campus (see the Association for Physical Plant Administrators in the **RESOURCES** section)

- **An adapted lab station** featuring an **adjustable height work bench** and sink that can accommodate a wheelchair. (See the **EXAMPLE** described at University of Lowell)
  Contempra Furniture Division of Fisher Scientific Co., New England Facility, 30 Water Street, PO Box 150, West Haven, CT 06516 (203) 934-5271; Info: (800) 245-6897, Fisher Scientific Contempra Furniture Plant, Indiana, PA 15701
- **A rolling laboratory platform**
  John T. Moore, Waymon Blair, Box 13006, SFA Station, Nacogdoches, TX 75962
- **An all-terrain vehicle** for fieldwork (For information and a list of distributors: Sports and Spokes, Volume 7, Number 6, March/April 1982, "All-Terrain Vehicles" (special section) pp. 11–22. Request reprints from Sports and Spokes, 5201 N. 19th Avenue, Phoenix, AZ 85015, (602) 246-9426.)
- **Handles, bars and/or handrails** firmly anchored wherever added support is needed
  Fred Sammons, Inc., Box 32, Brookfield, IL (write for local distributors)
  Lumex, Inc., 100 Spence Street, Bay Shore, NY 11706.
- **A variable-height wheelchair**
  For information: Dr. Jack M. Miller, Dr. Mary Richardson, or I. D. Brindle, Chemistry Department, Brock University, St. Catharines, Ontario, Canada L2S 3A1, (416) 688-5550
  Crecco's Mobility Systems for the Handicapped, RR2 Welland, Ontario, Canada L3B 5N5, (416) 892-3519
  Elevation Corporation, 619 Benvenue Avenue, Los Altos, CA 94022, (415) 948-8497
- **Accessible men/women's bathrooms** in the building **Creating An Accessible Campus,** pp. 87–92 (See the Association for Physical Plant Administrators in the **RESOURCES** section)
- **A raised platform with steps and saftey rail** so that people of short stature can work comfortably on a standard laboratory bench. (This is a homemade device used by Dr. Anne Swanson. Swanson is listed as a resource person in the **FOR EXAMPLE** section.)
- **Adapted safety equipment** (e.g. extended pull-chain or hose on drench showers; portable, lightweight fire extinguishers)

FOR VISUALLY IMPAIRED STUDENTS

- **A laboratory assistant or partner Teaching Chemistry to Physically Handicapped Students,** pp. 13–14 (see the American Chemical Society in the **RESOURCES** section)
- **A Talking Calculator**
  Innovative Rehabilitation Technology Inc., 26699 Snell Lane, Los Altos Hills, CA 94022, (415) 948-8588
- **Science Products Resource Guide,** Science Products, Box 4, Southeastern, PA 19399, (800) 822-7400; in PA (800) 222-2148
- **Tactile models** (Home made and commercial models are available for use in biology and geology.)
- **Optacon and Versabraille, Telesensory Systems** 455 N. Bernardo, P.O. 7455, Mountain View, CA 94043, (415) 960-0920
- **Journal of College Science Teaching,** Volume X, Number 6, May 1981, pages 355–357 (see the National Science Teachers Association in the **RESOURCES** section)
- **Raised-line drawings** to illustrate material shown on chalkboard, by overhead projector or under microscope.
- **Journal of Chemical Education,** March 1981, p. 223 (see the American Chemical Society in the **RESOURCES** section.)
  Howe Press, 175 North Beacon St., Watertown, MA 02172, (617) 924-3434
  Braille Materials Production Committee, National Braille Association, Inc., 1290 University Ave., Rochester, NY 14607, (716) 473-0900
- **Recording of Books and other Print Materials**
  Recording for the Blind, Inc., 20 Roszel Road, Princeton, NJ 08540, (609) 452-0606 or (800) 221-4792
- **Braille, large-letter, raised letter** or otherwise tactile labels American Printing House for the Blind, Inc., P.O.B. 6085, Louisville, KY 40206-0085, (502) 895-2405.
  Braille Materials Production Committee, National Braille Association, Inc., 1290 University Ave., Rochester, NY 14607, (716) 473-0900.
- **A talking thermometer**
  American Foundation for the Blind (See AFB in the **RESOURCES** section)
- **A thermometer with a raised dot scale**
  Science for the Blind Products (see SBP in the **RESOURCES** section)
- **A light probe**
  San Francisco Lighthouse for the

Blind, 1155 Mission St., San Francisco, CA 94103, (415) 431-1481
Science for the Blind Products (See SBP in the **RESOURCES** section)
American Printing House for the Blind, Inc., P.O.B. 6085, Louisville, KY 40206-0085, (502) 895-2405

- **Emphasis on verbal description**
- **Audio warning signals** (e.g., liquid level indicators) Science for the Blind Products (See SBP in the **RESOURCES** section)
- **A talking digital multimeter** Science for the Blind Products (See SBP in the **RESOURCES** section)
- **Projection of photomicrographic slides** on a wall, a screen **or a television** for partially sighted students
- **Talking clocks for timing devices**
  American Foundation for the Blind (See AFB in the **RESOURCES** section)
  Science for the Blind Products (see SBP in the **RESOURCES section)**
- **Measuring devices and drawing tools**
  The Howe Press, Perkins School for the Blind, 175 N. Beacon St., Watertown, MA 02172–9982
- **Clear aisles and work areas**
- **Talking computer terminals and braille printers**
  Maryland Computer Services, 2010 Rock Spring Road, Forest Hill, MD 21050, (301) 879-3366
  Triformation Systems, Inc., 3132 S.E. Jay St., Stuart, FL 33497, (305) 283-4817
- **Translator which simultaneously produces Braille and printed English**
  The Howe Press, Perkins School for the Blind, 175 N. Beacon St., Watertown, MA 02172-9982
- **Computer Adaptations and Accessories** Consult *Computer Equipment and Aids for the Blind and Visually Impaired* a reference book available from Computer Center for the Visually Impaired, Baruch College, 17 Lexington Ave., Box 515, New York, N.Y. 10010 at $24.50 per copy
- **Software to adapt APPLE II computers for the visually impaired** David Holladay, Raised Dot Computing, 408 South Baldwin, Madison, WI 53703, (608) 257-9595 (David Holladay has developed a program that will directly translate numbers entered in braille code to printed numerals.)

FOR VOCALLY AND SPEECH IMPAIRED STUDENTS

- **A reader** (i.e. if the student uses a manual communications board)
- **A device with a keyboard that "speaks" or prints out what is typed**

RESOURCES: ORGANIZATIONS AND PUBLICATIONS

To use this resource list effectively, write or telephone the organizations below with a specific question or questions. If you ask for everything they have, you are likely to receive reams of material. However, if you are a professional in the field seeking to build your own resource library such a request may be appropriate. In any case, it is important to assess your own needs and make your request as specific as possible.

In addition to the following resources, there are dozens of excellent articles concerning accessibility to the science classroom and laboratory. ***Science for the Handicapped: An Annotated Bibliography*** (listed under The National Science Teacher's Association) is a source of articles written through 1980. For more recent articles, NSTA will provide an updated supplement. When using the library, suggested search terms include: Deaf, Hearing Impaired, Blind, Visually Impaired, Mobility Impaired, Physically Handicapped, Science Laboratory.

- **Accent on Living,** P.O. Box 700, Bloomington, IL 61702 (309) 378-2961

Accent on Living, published and edited by Ray Cheever, is a quarterly publication ($6.00/year) which focuses on the needs of people with handicaps. Articles cover organizations, new products and inventions for the disabled, and ideas for recreation and daily living. Also available is the **Buyer's Guide** 1984–85 edition ($10.65), a 146-page sourcebook on products and services. They also have a computerized retrieval system for specific products or services. Write or call for cost and publications list.

- **Accommodating the Disabled Student,** James Mueller, $10.00, available from Rehabilitation, Research and Training Center, George Washington University, 2300 Eye Street NW, Suite 714, Washington, DC 20037, (202) 676-3801.

This publication illustrates how educational facilities can be designed or adapted to accommodate disabled students. Specifically, this publication focuses on the laboratory, the studio, the auditorium and the library. Through illustrations the author diagrams the accommodations that can be made for a variety of limitations due to disability.

- **Adapting Work Sites for People with Disabilities:** Ideas from Sweden (World Rehabilitation Fund, Inc. Monograph #20). Available from the National Rehabilitation Information

Center (see NARIC in this section).

Included in this handbook are specific physical plant adaptations as well as descriptions (accompanied by pictures) of a variety of adapted work sites for workers with various disabilities.

• **American Association for the Advancement of Science (AAAS),** Project on Science, Technology and Disability, 1333 H Street NW, 10th Floor, Washington, DC 20005, (202) 326-6667 (Voice/TDD).

The Project on Science, Technology and Disability is a national center for the concerns of disabled persons in science. The office focuses attention on the need for improved science career information and education for physically disabled youth. A resource of the Project includes a data base, ***Resource Directory of Scientists and Engineers with Disabilities.*** This Directory lists biodata on scientists and engineers with mobility, neurological, hearing, and visual impairments. These scientists have identified themselves as willing to serve as advisors to disabled science students and as consultants on a variety of subjects including laborabtory accessibility. Requests for referrals from the Data Base can be made by writing or calling AAAS.

Science for Handicapped Students in Higher Education, Martha Ross Redden, Cheryl Arlene Davis, Janet Welsh Brown, 1978. Available free through AAAS while the supply lasts. This monograph reports on the physical, attitudinal, informational, financial, and academic barriers which hinder the participation of handicapped students in the sciences, and strategies for removing the barriers. The report also includes recommendations for institutional changes.

Scientific and Engineering Societies: Resources for Career Planning, Editors, Virginia Stern and Martha Ross Redden, 1980. This publication offers counselors and students an overview of the wide range of career possibilities and the level of education required in science and engineering based on information provided by 82 professional societies. To order prepay $6.00 to AAAS Sales Department, 1333 H Street NW, Washington, DC 20005.

• **American Association of Colleges for Teacher Education,** Suite 610, One Dupont Circle, Washington, DC 20036, (202) 293-2450.

AACTE produced ***Educators with Disabilities: A Resource Guide.*** This publication includes a nationwide directory of over 900 handicapped educators and the results of a year's study of the experiences of disabled educators in being trained, certified, and employed as education professionals. This publication is out of print, but copies are usually available in the library of the Disabled Student Services Office in most colleges and universities.

• **American Chemical Society,** 1155 16th St. NW, Washington, DC 20036, (202) 872-8733 (Voice/TDD).

The Society's Committee on the Handicapped has published a manual entitled ***Teaching Chemistry to Physically Handicapped Students,*** Kenneth M. Reese, Editor, 1981 (revised edition 1985), free. This booklet offers suggestions and recommendations for making the chemistry classroom and laboratory accessible to disabled students. The manual also includes sections on laboratory safety, testing and evaluation, and sources of information. For more information or copies of the manual contact Terrence Russell, Ph.D, Staff Liaison, Committee on the Handicapped, (202) 872-4600, (Voice); (202) 872-8733 (TDD).

Chemical Health and Safety Referral Services is for inquirers concerned with chemical health and safety questions. Resources for referral include books, periodical articles, films, educational programs, and government agencies and other organizations oriented to health and safety matters. The service is available by telephone at (202) 872-4511.

Journal of Chemical Education, Volume 53, Number 3, March 1981. This special issue includes the following articles: "Attitudinal Barriers for the Physically Handicapped;" "Chemistry and the Visually Handicapped," "Chemistry and the Hearing Impaired;" "Mobility-Handicapped individuals in the College Chemistry Curriculum: Students, Teachers and Researchers;" "A Rolling Laboratory Platform for the Mobility Impaired;" "Chemistry and the Visually Impaired: Available Teaching Aids;" "Teaching Aids for Visually Handicapped Students in Introductory Chemistry Courses;" "High Technology Laboratory Aids for Visually Handicapped Chemistry Students;" "Laboratory Instruction for the Motor Impaired;" "Safety Considerations for Physically Handicapped Individuals in the Chemistry Laboratory;" and the editorial, "Chemistry and the Disabled Student."

The Filter Paper, Volume 14, Number 1, Fall 1981. Although out of print, a copy of this edition of ACS's student affiliate newsletter should be available in college and university chemistry department libraries. This newsletter focuses on Education in Chemistry for the Handicapped. Following an introduction describing the ACS committment to assist physically handicapped students in chemistry, there are three biographical sketches of disabled scientists. In addition, Anne Swanson, a disabled professor of chemistry, describes the responsibilities and goals of the ACS Committee on the Handicapped.

• **American Foundation for the Blind,** 15 West 16th Street, New York, NY 10011, (212) 620-2171

The Foundation supplies a free catalogue, ***Products for People with***

Vision Problems, 1982–83 (free). Some items available through AFB are a talking thermometer, a talking micrometer, a talking Vernier caliper. To order the catalogue call or write the Consumer Products Department.

• **American Printing House for the Blind, Inc.,** 1839 Frankfort Ave., P.O. Box 6085, Louisville, KY 40206–0085, (502) 895-2405 TWX810–535–3449. Items customarily produced in print for the sighted population can be made available to visually handicapped people through the services of the APH. They have the in-house capability of production and duplication of braille, large type, flexible records, and cassette tapes. For a free cost estimate you should send a copy for each medium of the item desired. Send to the attention of the Editorial Department.

The APH also has for sale instructional aids, tools, supplies and promotional materials for persons with visual impairments. Several catalogs are available free of charge from APH. A description of catalogs and promotional materials available from APH is available from the APH address listed above.

• **American Psychological Association,** 1200 17th Street, NW, Washington, DC 20036, (202) 833-7572; contact: Dr. Arnold S. Kahn

APA sponsors a Task Force on Psychology and the Handicapped. The Task Force has set up a network of psychologists who have disabilities and other individuals who work with persons with disabilities to serve as resources and role models.

• **Assistive Device Center,** School of Engineering, California State University, 6000 J Street, Sacramento, CA 95819, (916) 454-6422, Dr. Albert Cook, Director; Helen Woodall, Resource Coordinator

The Assistive Device Center has established a data base consisting of information on assistive devices, bibliographic references, service agencies, and resource persons for disabled students in science and engineering.

• **Association on Handicapped Student Services Programs in Postsecondary Education (AHSSPPE),** Executive Director, Jane Jarrow, PO Box 21191, Columbus, OH 43221, (614) 457-5681.

AHSSPPE is an association of leaders in the field of providing services to disabled students on college campuses. Information sharing is a key element of their goal, which is to upgrade the quality of services available to disabled students. Membership fee is on a sliding scale and includes the newsletter, ALERT.

• **Association of Physical Plant Administrators,** 1446 Duke Street, Alexandria, VA 22314, (703) 684-1446

APPA offers technical assistance to schools that are making their physical plants more accessible to persons with disabilities. Among their publications are ***Adapting Historic Campus Structures for Accessibility*** ($10.50 non members; $7.50 members) by Margaret Milner; ***Modifying the Existing Campus Building for Accessibility: Construction Guidelines and Specifications*** ($10.50 non members; $7.50 members) by Stephen Cotler; and ***Steps Toward Campus Accessibility*** ($10.50 non members; $7.50 members). Also available from APPA is a reprint of the chapter "The Handicapped Student in the Science Laboratory" by Robert P. Larsen, Richard Buchanan and Frank P. Lorrey, from ***Creating An Accessible Campus*** (out of print). The major focus of this chapter is on descriptions of laboratory accommodations and safety considerations.

• **Center for Multisensory Learning,** Dr. Herbert D. Thier, Director, Lawrence Hall of Science, University of California, Berkeley, CA 94720, (415) 642-8941

This organization has developed hands-on science materials for multisensory science experience for physically disabled youth, including Science Activities for the Visually Impaired and Science Enrichment for Learners with Physical Handicaps (SAVI/SELPH). For more information contact Coordinators Linda DeLuchi or Larry Malone.

Committee on Personal Computers and the Handicapped (COPH-2), 2030 Irving Park Road, Chicago, IL 60618, (312) 477-1813

COPH-2 is a consumer organization whose purpose is to search out, evaluate, and share information about personal computers that is relevant to persons with disabilities. Annual membership fee is $8.00 which includes, among other services, a quarterly newsletter, a directory of persons with computers who are willing to share information (Enter-Act), computer loans, and technical assistance for blind and other disabled persons.

• ***Cost Effective Ideas*** by Susan Bardellini Forman, Rhona C. Hartman, and Michael Zimmerman, February 1983 (updated 1985), available from the HEATH Resource Center, One Dupont Circle, Suite 670, Washington, DC 20036, (202) 939-9320 or (800) 544-3284

This fact sheet identifies long range planning strategies, suggests specific questions to ask prior to initiating a program or purchasing equipment, and pinpoints a number of cost effective ideas now in use on American campuses.

• ***Fire Safety for Hearing-Impaired People,*** The Environmental Design Center for the Deaf, Gallaudet College, 7th and Florida Avenue NE, Washington, DC 20002, (202) 651-5218 (Voice/TDD)

This brochure describes the fire safety prevention and control pro-

gram, the emergency signals used and the evacuation procedures established at Gallaudet College. The brochure is available free from the above address and telephone number.

• **Foundation for Science and the Handicapped (FSH),** 154 Juliet Court, Clarendon Hills, IL 60514; Dr. Phyllis Stearner, Treasurer

FSH is an organization of handicapped scientists which functions as a resource and advocacy group promoting access to science education and employment for the handicapped. FSH publishes a periodic newsletter and awards several scholarships to disabled science students in college.

FSH has published a collection of biographical profiles of disabled scientists to serve as a resource of role models—and consultants for disabled students, their teachers, counselors, families, who are responsible for guiding disabled students. The title of this book is ***Able Scientists—Disabled Persons: Biographical Sketches Illustrating Careers in the Sciences for Able Disabled Students,*** by S. Phyllis Stearner, 1984, with a Foreward by Martha R. Redden (softbound, 80 pages, 27 illustrations). Available from Foundation for Science and the Handicapped, Inc., 154 Juliet Court, Clarendon Hills, IL 60514. Prepay $12.95; Schools and Professional Organizations $9.95.

• **Gallaudet College Press,** Distribution Office, 7th Street & Florida Avenue NE, Washington, DC 20002, (202) 651-5591 (Voice); 651-5355 (TDD).

The Gallaudet College Press has available ***The Deaf Student in College.*** This book, updated nearly every year, is written for administrators of universities, colleges, and other postsecondary institutions. ***The Deaf Student in College*** provides guidance for developing services for hearing impaired students on campuses. It also lists some institutions offering special services to hearing impaired students. Stock No. 0407; cost: $2.00 plus 10% shipping and handling ($1.00) minimum). 10% discount to libraries, schools, and educational facilities.

The Deaf Student in College: Beyond the Classroom. A resource folder for college personnel interested in improving the total college environment for deaf and hearing-impaired students. The folder contains three copies of a 16-page booklet and nine information sheets. Stock No. 0413; cost: $2.00 plus 10% shipping and handling ($1.00 minimum). 10% discount to libraries, schools, and educational facilities.

• ***Measuring Student Progress in the Classroom,*** by Rhona Hartman and Martha R. Redden, June 1982 (updated 1985). Available from the HEATH Resource Center, One Dupont Circle, Suite 670, Washington, DC 20036, (202) 939-9320 or (800) 544-3284

This fact sheet is a guide to testing and evaluating progress of students with disabilities. Included are considerations in testing disabled students, functional limitations, examination adaptations, as well as selected publication and resource persons identified through Project HEATH.

• **The National Braille Association, Inc.,** 1290 University Avenue, Rochester, NY 14607, (716) 473-0900.

The National Braille Association (NBA) national office in Rochester is the home of the Braille Materials Production Center, a central source for braille readers. Over 1,800 book titles, including music scores, supply college students, professionals and other adults with technical and non-technical materials for school, work and recreation. Catalogs are available in print and braille. The collection is continuously updated and augmented by NBA transcriber assignment services.

Certified braillists, experienced in textbook transcription (including such specialized areas as mathematics, chemistry, statistics, finance, computer science, foreign language and music), fill requests for college textbooks and other technical materials. Personal items of general interest that are helpful in work, recreation and daily living are also transcribed by certified braillists. Selected transcriptions are added to the NBA collection and listed in the appropriate catalog for further circulation. For further information contact NBA at the above address.

• **National Federation of the Blind,** 1800 Johnson Street, Baltimore, MD 21230, (301) 659-9314.

NFB publishes ***Postsecondary Education and Career Development: A Resource Guide for the Blind, Visually Impaired, and Physically Handicapped.*** This publication contains advice on notetaking, testing options, procedures for making campus contacts, and places where texts can be transcribed and materials of any sort can be located around the country. This publication can be ordered from the above address by prepaying $4.95.

• **National Rehabilitation Information Center (NARIC),** 4407 8th Street NE, The Catholic University of America, Washington, DC 20017–2299, (202) 635-5822 (Voice/TDD).

NARIC is a rehabilitation information service and research library. NARIC operates two databases—**REHABDATA:** a computerized listing of over 12,000 documents and containing National Institute of Handicapped Research and Rehabilitation Services Administration funded research reports, journal articles and related references; and **ABLEDATA:** a computerized listing of over 11,000 commercially available products for

rehabilitation and independent living, including products that extend from the simple to the sophisticated and reflect a broad range of equipment needs. In addition, NARIC's library contains information on all items listed on REHABDATA and catalogs for all products listed on **ABLEDATA.** NARIC's extensive resources offer a wide variety of information resources. Customized database searches are available for a nominal fee, and fact and referral services are free. Contact the NARIC Information Team for additional information.

• **National Science Teachers Association (NSTA),** 1742 Connecticut Avenue NW, Washington, DC 20009, (202) 328-5800; contact: Dr. Helenmarie Hofman.

Science for the Handicapped Association (SHA) c/o Ben Thompson, UWEC-B272, Eau Claire, WI 54701, (715) 836-4164; Dr. Ben Thompson Secretary/Treasurer. SHA promotes science for all handicapped children and youth. The Association publishes a newsletter containing bibliographic citations on science for the handicapped as well as descriptions of current research, conferences, and courses. SHA will supply an updated bibliography for $.50 if requested. SHA requests a donation of $5.00 annual dues.

Sourcebook: Science Education and the Physically Handicapped, 1979, Editors: Helenmarie H. Hofman, Ph.D. and Kenneth S. Ricker, Ed.D., National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, DC 20009, (202) 328-5800 ($9.00 plus postage and handling). This publication consists of a collection of papers and articles covering the following general areas: "Science Education and the Handicapped," "Science for Everyone," "Preparing Teachers to Work with the Handicapped," "Resources for Teachers/Schools," "Science and the Orthopedic Handicapped," "Science and the Visually Handicapped," "Extending the Science Program Beyond the School," "The Handicapped and Careers in Science and Related Fields," and "Science Education and the Handicapped: Implications for the Future."

Journal of College Science Teaching, Volume X, Number 6, May 1980, The National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, DC 20009. This issue of the Journal includes the following chapters: "Overview of the National Science Foundation Project on the Handicapped in Science," "Teaching Biology to Visually Handicapped Students," "The Physically Handicapped Student in Biology," "The Mobility-Handicapped Student in the Science Laboratory," "Teaching Chemistry to the Hearing Impaired," "Research Exposure for Physically Handicapped Science Students: An Educational Program in a Research Setting," "A Variable Height Wheelchair," and an editorial, "Assuring Access to Handicapped Students—Whose Responsibility?"

• **National Technical Institute for the Deaf,** Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY 14623–0887, (716) 475-6824 (Voice/TDD).

The National Technical Institute for the Deaf (NTID) at Rochester Institute of Technology (RIT), a technological college for deaf students, is attended by 1250 deaf students within a college campus planned primarily for hearing students.

NTID affords postsecondary deaf students the opportunity to prepare for and pursue semi-professional and professional level educational programs in applied science/allied health, engineering technologies, visual communications, business, and computer careers from programs based within NTID or from 200 other courses offered at RIT.
The Institute utilizes state-of-the art technology to facilitate learning by hearing-impaired students and provides other support services (tutors, notetakers, and interpreters). In addition, the Institute serves as a resource to other educational institutions involved in mainstreaming people into regular classes by conducting training programs for interpreters, notetakers, and tutors.

The ***NTID Catalog of Educational Resources*** contains a list of videotapes of Technical Signs that are used in science classroom and laboratory settings. It also lists other resources such as notetaking information and materials, captioning information, and teaching guides.

• **Recording for the Blind, Inc.,** 20 Roszel Road, Princeton, N.J. 08540, (609) 452-0606 or (800) 221-4792

This national non-profit voluntary organization provides recorded educational books free-on-loan to individuals who cannot read standard printed material because of visual, physical or perceptual handicaps. RFB services aid print handicapped students at all levels as well as those who require educational or specialized material for their job.

• **Rehabilitation Engineering Society of North America (RESNA),** Suite 402, 4405 East-West Highway, Bethesda, MD 20814, (301) 657-4142, Pat Horner, Executive Director.

This organization can respond by mail to specific questions about modifying existing equipment and designing new devices. The Executive Director reads the letters of inquiry and forwards them to a board member with relevant expertise.

• ***Resource Book: Teaching the Physically Disabled in the Mainstream Science Class at the Secondary and College Levels,*** E.C. Keller, Jr., T.K. Pauley, E. Starcher, M. Ellsworth, B. Proctor (1983). Available for $6.50 (postpaid) from Printech, 1125 University Avenue, Morgantown, WV 26505, (304) 296-0078.

This book is directed toward the science teacher with one or more physically disabled students. Included are definitions and implications of hearing impairments, visual impairments, and/or motor/orthopedic impairments. General teaching strategies are presented and specific strategies and assistive devices are listed by disability and teaching method. A thermoform insert is also included.

• **Science Products** (formerly Science for the Blind Products), Dr. and Mrs. Tom Benham, Box A, Southeastern, PA 19399, (215) 296-2111. ***Science Products Resource Guide*** ($2.00) is a catalog which lists a variety of products and devices for blind students and scientists. If you need something which you don't find in the catalog, you may call Dr. Benham at (215) 296-2114. It's more than likely he or one of his staff will come up with a solution for you.

• ***Science for the Handicapped: An Annotated Bibliography,*** 1980, Editor: Ben Thompson, available from ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Information Reference Center, Ohio State University, 1200 Chambers Road, Third Floor, Columbus, OH 43212 ($4.03).

This extensive bibliography is divided into General and Research sections related to Visually Impaired, Hearing Impaired and Other Handicapping Conditions.

• ***Signs for Computing Terminology,*** 1983, Steven Jamison, available from the National Association of the Deaf, 814 Thayer Avenue, Silver Spring, MD 20910, (301) 587-6282 ($10.95)

This book diagrams those signs related to computer science. There are also three video tapes (one hour each) which follow the book. The video tapes are available now for $125 each.

• **Special Materials Project**—Captioned Films for the Deaf and Handicapped Learners Materials, 814 Thayer Avenue, Silver Spring, MD 20910, (301) 587-5940 (Voice/TDD)

SMP distributes captioned films, both educational (requires at least one hearing impaired student) and theatrical (requires at least six hearing impaired individuals—no hearing individuals). There are films of science content, although most are at the primary and secondary level. Write or call for account application and additional information.

• ***Testing Physically Handicapped Students in Science: A Sourcebook for Teachers, 1981,*** Editor: Harry G. Lang. Available for $4.50 (postpaid) from Printech, 1125 University Avenue, Morgantown, WV 26505 (304) 296-0078.

This publication provides suggestions and recommendations for the development of teacher-made achievement tests in science for students with visual, hearing, and/or motor/orthopedic impairments.

This fact sheet was originally prepared by Michael Zimmerman, HEATH Resource Center, and Martha Ross Redden, Director of the Project on the Handicapped in Science, American Association for the Advancement of Science and Consultant to the HEATH Resource Center, with the assistance of Susan Bardellini Forman, Research Assistant, AAAS, June 1983; and updated by Martha Ross Redden, Judy Kass, Project Assistant, and Cricket Levering, Data Management Consultant, AAAS, December 1985.

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American Association for the Advancement of Science

The Project on Science, Technology and Disability of the American Association for the Advancement of Science (AAAS), in Washington, D.C., maintains a **Resource Group of Scientists and Engineers with Disabilities,** which currently numbers more than 1200. Since 1975, members of the **Resource Group** have consulted with schools and colleges, employers, legislators, and other disabled persons, thereby helping to open doors to education and careers in science, math, and engineering for interested disabled people. The **Directory** (Second Edition to be published in 1987), which lists names and other helpful data about scientists and engineers with disabilities, is also a valuable resource tool for faculty, administration, and disabled students seeking information on better access to educational programs, including adaptations to academic and industry-based laboratories.

The AAAS **Resource Directory of Scientists and Engineers with Disabilities** is continuing to accept new names and revisions for their data base. There is a need to identify as many disabled scientists (including social scientists), engineers, mathematicians, and students of all science, engineering, and mathematics fields as possible.

Please identify yourself or someone you know who meets these qualifications. AAAS will contact those persons identified and provide more information about joining the **Resource Group** and being listed in the Second Edition of the **Resource Directory.** AAAS will not use, without permission, the names of individual scientists or students of science who respond. Please write or call the Project on Science, Technology and Disability, AAAS, 1333 H Street, NW, Washington, D.C. 20005. 202/326-6667 (voice/TDD).